Research Article

Joshua Ombaka Owade*, George Ooko Abong', Michael Wandayi Okoth, Agnes Wakesho Mwang'ombe

Trends and constraints in the production and utilization of cowpea leaves in the arid and semi-arid lands of Kenya

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Abstract: Cowpea (*Vigna unguiculata*) leaves are nutritious indigenous vegetables that are produced and consumed among local communities in Kenya. However, seasonal production limits their utilization. The study investigated the changing trends in the consumption and utilization of cowpea leaves among cowpea producing households in arid and semi-arid land (ASAL) areas. A cross-sectional survey of randomly selected households producing and consuming cowpea leaves was carried out in Eastern and Coastal ASALs of Kenya to determine the trends and constraints in the production and utilization of the vegetable, thus evaluating its efficiency as a food security crop. The average household production in a season was found to be 3.03 ± 0.9 of 90 kg bags. Lesser severity of the constraints, poor soils, drought, lack of access to seeds and massive spoilage with an odds ratio of 0.4, 0.9, 2.0 and 2.3, respectively, significantly ($p < 0.05$) predicted the production quantities among households, $R^2 = 0.21$. The study also found that the reliance on own production among households for sourcing the leaves in-season and off-season was 97.5% and 24.9%, respectively. The households consumed the leaves in boiled (87.5%), sundried (27.5%) or blanched (13.6%) forms. Households in the coastal ASALs significantly ($p < 0.05$) consumed more of dried forms (odds ratio: 3.3) but less of boiled ones (odds ratio: 0.1) than those in the Eastern parts. Households that had more members or a female deciding the food to be bought had significantly ($p < 0.05$) higher frequency of consumption of cowpea leaves. Marketing challenges, lack of access to inputs and inadequate postharvest technologies for preservation of the vegetables constrained the production and utilization of cowpea leaves. In order to promote the availability and utilization of cowpea leaves both in and out of season, accessibility of good quality seeds and postharvest management are necessary.

Keywords: cowpea leaves, consumption, household preferences, environmental constraints, ASALs

*** Corresponding author: Joshua Ombaka Owade,** Department of Food Science, Nutrition and Technology, University of Nairobi, P.O. Box 29053-00625, Nairobi, Kenya, e-mail: owadehjm@gmail.com
George Ooko Abong', Michael Wandayi Okoth: Department of Food Science, Nutrition and Technology, University of Nairobi, P.O. Box 29053-00625, Nairobi, Kenya
Agnes Wakesho Mwang'ombe: Department of Plant Science and Crop Protection, University of Nairobi, P.O. Box 29053-00625, Nairobi, Kenya

1 Introduction

Cowpea (*Vigna unguiculata*) is a multi-purpose indigenous crop that grows largely in the tropics of sub-Saharan Africa (SSA) (Enyiukwu et al. 2018a; Sobda et al. 2018). FAOSTAT (2019) reported that 95.6% of the area under cultivation of cowpea leaves worldwide in 2017 was in SSA. The crop is also known to be short-term and drought tolerant. The leaves and the grains of the crop are utilized for food in various cuisines among local communities in Kenya (Owade et al. 2019). Additionally, the crop also has the shade tolerance property that has made it easier to intercrop it with other major crops including maize and sorghum. The leaves of the crop have been identified as one of the African leafy vegetables for the improvement of food and nutrition security in SSA (Kirigia et al. 2018). On top of being a human food, the crop has also been utilized for forage.

With the rising interest in orphan crops that are well suited to the harsh environmental conditions in arid and semi-arid lands (ASALs), cowpea leaves are one of the vegetables that are being promoted for both the leaves and the seeds. The annual production of cowpea leaves in 2016 was reported to be 1,15,801 MT (Horticultural Crops Directorate 2016). The leaves are consumed fresh, dried or fermented among local communities in the country. The utilization of the leaves of the crop for food

avails nutrients such as beta-carotene, iron and protein whose deficiency is rampant among the vulnerable population of SSA (Kirigia et al. 2018). Moreover, the cowpea leaves are also rich in calcium, zinc, fibre and phytonutrients (Enyiukwu et al. 2018b). Due to this, there are nutrition intervention programmes that are promoting the cultivation of the crop for its leaves.

Even with the known nutritional benefits of cowpea leaves, their utilization and production for food have been less than optimal. The crop has largely been neglected and has a limited value chain due to limited research on its utilization and value addition (Mfeka et al. 2019). The production and utilization of cowpea leaves have largely been seasonal owing to a myriad of challenges including limited postharvest handling technologies. The producers of the leafy vegetable lack appropriate storage and postharvest technologies that would enhance its availability in and out of season (Kirigia et al. 2018). Additionally, during glut, there are massive postharvest losses of cowpea leaves. Local communities in Kenya have indigenous value-addition techniques that they employ to enhance the availability of this vegetable; however, documented studies are yet to report on such practices, their scope and their constraints. The current study seeks to avail this information with a view of ensuring that good traditional practices can be improved, scaled up and replicated in these areas to enhance the availability of the vegetable and contribute to the efforts aimed at alleviating food and nutrition security.

2 Materials and methods

2.1 Study area

The study was conducted in Kitui and Taita Taveta Counties (Figure 1) which are rated among the highest producers and consumers of cowpea vegetables (Horticultural Crops Directorate 2016). Taita Taveta County is located in the coastal ASALs and is divided into 4 sub-counties and 20 administrative wards (County Government of Taita Taveta 2018). The county is situated between the latitudes 20°46′ and 40°10′ North and the longitudes 37°36′ and 39°14′ East (Apollo et al. 2017). According to the Kenya National Bureau of Statistics (KNBS), the estimated population of Taita Taveta County in 2018 was 3,23,867 persons of which 57.2% were living in absolute poverty (contributed 1.1% to national poverty) (GoK 2015).

Kitui County is the sixth largest county by land area in Kenya covering 30496.4 km^2. The County is the largest in the eastern ASAL areas; a region that has erratic rainfall and drier conditions than the coastal ASAL areas (County Government of Kitui 2014). It lies between the latitudes 0°10′ South and 3°0′ South and the longitudes 37°50′ East and 39°0′ East (County Government of Kitui 2018). Kitui County is divided into eight sub-counties that are further divided into wards that are 40 in number in the whole county. The population of the county according to the 2009 census stood at 1.013 million people (County Government of Kitui 2014), with a projection for it to have increased to 1.1 million in 2018. The main economic activity of the county is Agriculture (Wambua et al. 2016). Crops grown in the area include vegetables, fruits, sweet potatoes, cassava, green grams, maize, beans, sorghum and pigeon peas (Mutunga et al. 2017).

2.2 Study design

The study involved a cross-sectional survey of randomly sampled households that were involved in the production of cowpea leaves in Kitui and Taita Taveta Counties. Households that were producers and consumers of cowpea leaves were incorporated into the study. A semi-structured questionnaire was administered using the open data kit (ODK) mobile application.

2.3 Study population and sampling

2.3.1 Sampling criteria

Kitui and Taita Taveta Counties were purposively selected for the study as they ranked among highest producers and consumers of cowpea leaves. Nguuni ward in Kitui and Mwanda Mgange and Wumingu and Bura wards from Taita Taveta which were the highest cowpea leaves producing areas in the study areas were further purposively selected for the study. These wards were located in Kitui Central Sub-County in Kitui County and Mwatate and Wundanyi Sub-Counties in Taita Taveta County. The respondents from households involved in the production of cowpea leaves from these wards were then randomly selected for the study.

2.3.2 Sample size determination

The study included 405 respondents as per the minimum sample size determined using the Yamane 1967:886 formulae as explained by Israel (1992), equation (1):

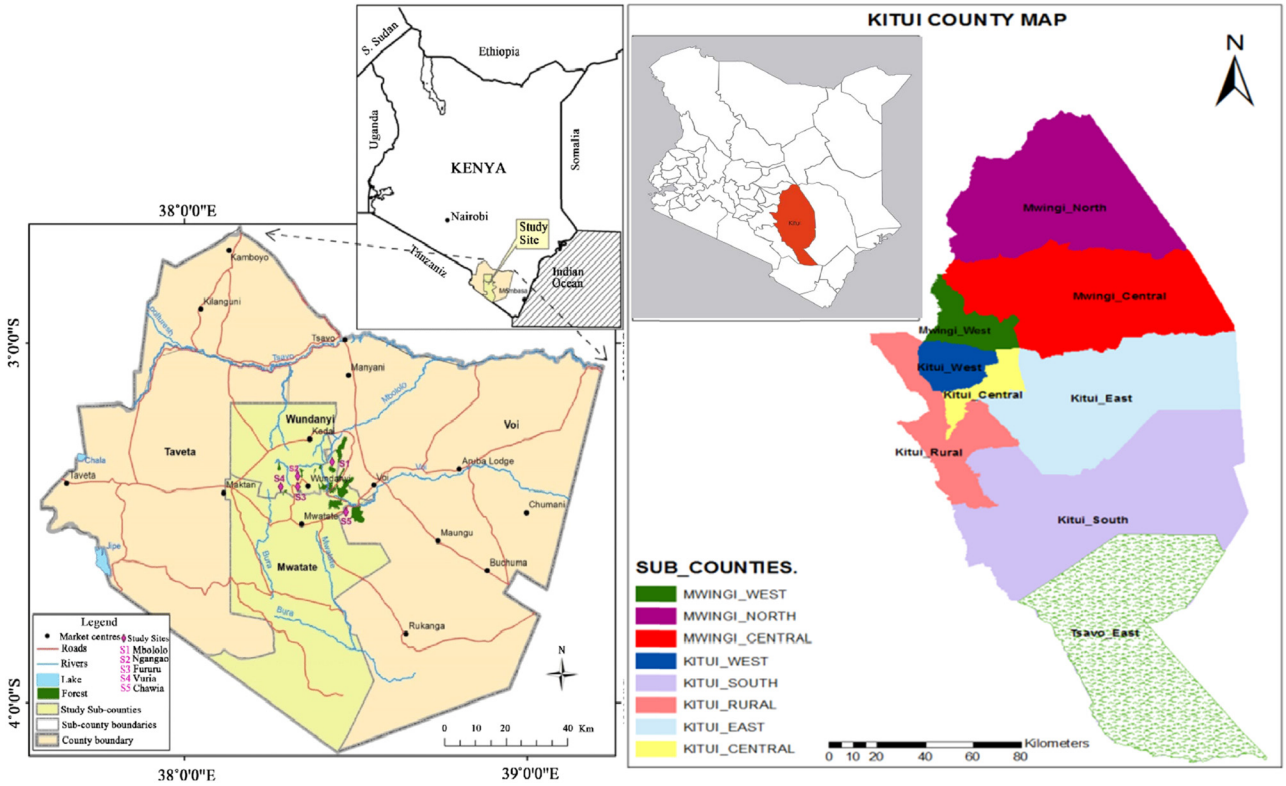

Figure 1: Map of Taita Taveta and Kitui Counties. Source County Government of Kitui (12) and GoK (10).

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

$n = \frac{2,76,581}{(1+2,76,581(0.05)^2)} = 399.42(400)$, where N (2,76,581) is the total number of households in the two counties as per KNBS (2013) and e is the maximum variability (0.05) permitted.

2.4 Data collection procedures

2.4.1 Data collection tools

A semi-structured questionnaire was developed evaluating the production, processing and utilization of cowpea leaves. The questionnaire was pretested among 20 households in Wundanyi Sub-County that were not included in the actual study. Additional questions and multiple responses were generated from the exercise.

2.4.2 Recruitment and training of enumerators

Enumerators and research assistants were recruited and trained on ODK application for data collection and the data collection tools. The enumerators were trained on data collection ethics, administration of the questionnaire and operation of the ODK application. The questions were also explained to the enumerators. The questionnaire was then pretested among ten randomly sampled respondents in areas in the study area that were not part of the study. Data collection was done by administering semi-structured questionnaires to randomly selected households that were producers of cowpea leaves. Written consents of the respondents were sought once the study objective had been explained to them but before their participation in the study.

2.4.3 Statistical analysis

The data were analysed in R Project for Statistical Computing, R-3.6.3 (R Core Team 2019). Summary statistics such as frequencies for the socio-demographic and economic characteristics, challenges faced and forms of utilization were obtained. Chi-square (χ^2) test of association was used to ascertain the influence of the county of residence on the trend of utilization and production. Generalized linear model was used to test the predictor constraints of production on the quantity of cowpea leaves produced. Dummy variables

were first generated from the categorical variables for ease of creating a linear model. Linear modelling was used to determine socio-demographic factors that would predict the utilization and intake of cowpea leaves. Significance was tested at $p < 0.05$.

2.5 Results

2.5.1 Socio-economic and demographic characteristics

The socio-demographic and economic characteristics of the study population are summarized in Table 1. Of the households that were involved in the study, 50.6% were from Coastal ASAL areas (Taita Taveta County), whereas 49.4% were from Eastern part (Kitui County). The household heads were mainly males (72.3%) and had farming (72.9%) as their main occupation. Majority (97.5%) of the households sourced their vegetables from their farm. Reliance on the farm as the major source of the vegetable was significantly ($p < 0.05$) associated with the county of residence. Cowpea leaves were the most preferred priority vegetable across the two counties with over 80% of the households preferring them (Figure 2). The county of residence of the households and the gender of the household head significantly ($p < 0.05$) influenced the prioritization of the cowpea leaves as a vegetable and the reliance on the farm as their major source. The cowpea leaves were regarded more in the Eastern region as a major farm produce based on the yields compared to Coastal areas ($p < 0.05$) as shown in Figure 3.

2.5.2 Constraints to the production

Drought and field pests were ranked as the top two severe challenges constraining the utilization of cowpea leaves in the two counties (Table 2). The challenges experienced did not significantly ($p > 0.05$) differ between the two regions.

2.5.3 Trends of production of cowpea leaves

The mean average time for initiation of harvesting the leaves was found to be 2.58 ± 1.26 WAE, with an average harvesting period of 2.22 ± 1.79 weeks and a termination period of 7.36 ± 3.99 WAE. The period of initiation, interval and termination of harvesting was not significantly ($p > 0.05$) different across the two counties. The demographic characteristics of the household head did not significantly ($p > 0.05$) influence the period of initiation, interval and termination of harvesting of cowpea leaves.

About three quarters (73.8%) of the households growing cowpea leaves preferred them to other crops as they gave higher yields. The households planted cowpea leaves for averagely two seasons (1.9 ± 0.3). The landrace (local) varieties were the most grown varieties by up to 86.2% of the households. Nearly all (98.5%) the households preferred plucking the leaves rather than uprooting the plant as the method of harvesting cowpea leaves. Averagely in both counties, both intercropping and monocropping were practiced in equal measure (Figure 4). However, majority (65.7%) of the households in Kitui County preferred intercropping cowpea leaves with other crops, whereas majority (67.2%) of those in Taita Taveta County used the monocropping system for cultivation of the crop. Significantly ($p < 0.05$) higher proportion of households in Kitui County preferred to harvest in the morning compared to those from Taita Taveta County as shown in Figure 5. Only two thirds (66.9%) of the households were involved in the sale of the produce they harvested. Of the households that sold the vegetable, women were more involved (84.6%) than the men (53.3%). Three quarters (77.8%) of the households would also harvest the grains from the crops. A higher proportion of households in Taita Taveta County (43.1%) than in Kitui County (1.7%) did not utilize the grains ($p < 0.001$, df = 2 and $\chi^2 = 102.9$).

The average production quantity of cowpea leaves of the farmers was 3.03 ± 0.9 of 90 kg bags in a season. The production quantity among cowpea growing households in Kitui County was 4.5 ± 0.3 of 90 kg bags per season; this was significantly ($p < 0.05$, $t = 254.8$) higher than those of households from Taita Taveta County that had production quantity of 1.5 ± 0.1 of 90 kg bags. The significant ($p < 0.05$) predictor factors of production quantities of cowpea leaves included access to seeds, availability of market and weeds with an R^2 of 0.21 (Table 3). The regression equation for production quantity of cowpea leaves was as shown in the following equation:

$$y = 2.5 - 1.0x_1 - 0.1x_2 + 0.7x_3 + 0.9x_4, \quad (2)$$

where y is the production quantity in 90 kg bags (number of bags); x_1, x_2, x_3 and x_4 are the variables: lack of poor soils (moderate), drought (moderate), lack of access to seeds (moderate) and massive spoilage (low), respectively.

Table 1: Socio-economic and demographic characteristics of households producing cowpea leaves

Socio-economic and demographic characteristics	County of residence		Total	χ^2 (*p*-value, df)
	Taita Taveta	Kitui		
Number of respondents (%)	50.6	49.4	100	Na
Gender of household head (%)				
Male	66.8	78.0	72.3	6.3 (0.012, 1)
Female	33.2	22.0	27.7	
Level of education of household head (%)				
Never went to school	12.7	21.0	16.8	47.4 (<0.001, 4)
In primary	3.4	21.5	12.4	
Completed primary	47.5	24.5	36.1	
In secondary	1.5	2.0	1.7	
Completed secondary	14.2	15.0	14.6	
University and Tertiary	4.9	5.0	5.0	
Main occupation of the household head (%)				
Salaried employment	5.9	7.5	6.7	5.8 (0.325, 5)
Farmer	71.8	74.0	72.9	
Trading and other informal businesses	9.4	10.5	10.0	
Casual labour	7.9	6.0	7.0	
Unemployed	4.5	1.0	2.7	
Not applicable: students and underage	0.5	1.0	0.7	
Who decides food to be bought (%)				
Man	46.8	34.5	40.7	21.5 (<0.001, 2)
Woman	52.7	55.5	54.1	
Both man and woman	0.5	10.0	5.2	
Consumption of cowpea leaves in glut (%)				
Yes	99.0	99.5	99.3	0.3 (0.573, 1)
No	1.0	0.5	0.7	
Household monthly income (%)				
<3,000 KES	59.5	35.5	47.7	40.1 (<0.001, 4)
3,000–10,000 KES	33.2	37.0	35.1	
10,000–25,000 KES	5.9	13.0	9.4	
25,000–50,000 KES	1.0	12.0	6.4	
>50,000 KES	0.5	2.5	1.5	
Average age of household head (years)**	50.1 ± 16.2	50.7 ± 16.1	50.4 ± 16.1	−0.3* (0.731, 403)
Household size (persons)**	3.4 ± 2.2	6.8 ± 3.1	5.0 ± 3.2	−12.5* (<0.001, 359)

Significance for all the dependent variables was tested using Chi-square test except for those indicated with ** where *t*-test was used. **t*-value. na – significance was not tested due to the lack of variation.

The regression equation has an R^2 of 0.21 and a constant of 2.5 at $p < 0.05$. The reference category for both low and moderate groups is severe. * significant at $p < 0.05$, ** significant at $p < 0.001$.

2.5.4 Trends of utilization of cowpea leaves

The most preferred forms of cowpea leaves that were utilized in the households included the boiled (87.5%), sundried (27.5%) and blanched (13.6%). Households from Taita Taveta had odds ratios of 3.3 and 0.1 of consuming boiled and sundried forms of cowpea leaves, respectively, compared to those from Kitui County, whereas the male-headed households also had an odds ratio of 2.5 of consuming the blanched forms as compared to the female-headed ones at $p < 0.05$. In as much as the frequency of consumption of cowpea leaves in the households across the two counties averaged at 3.4 ± 1.7 days in a week, households in Kitui County posted a higher frequency of 4.1 ± 1.7 days in a week as compared to 2.7 ± 1.3 days a week for households in Taita Taveta County ($p < 0.05$) during in-season.

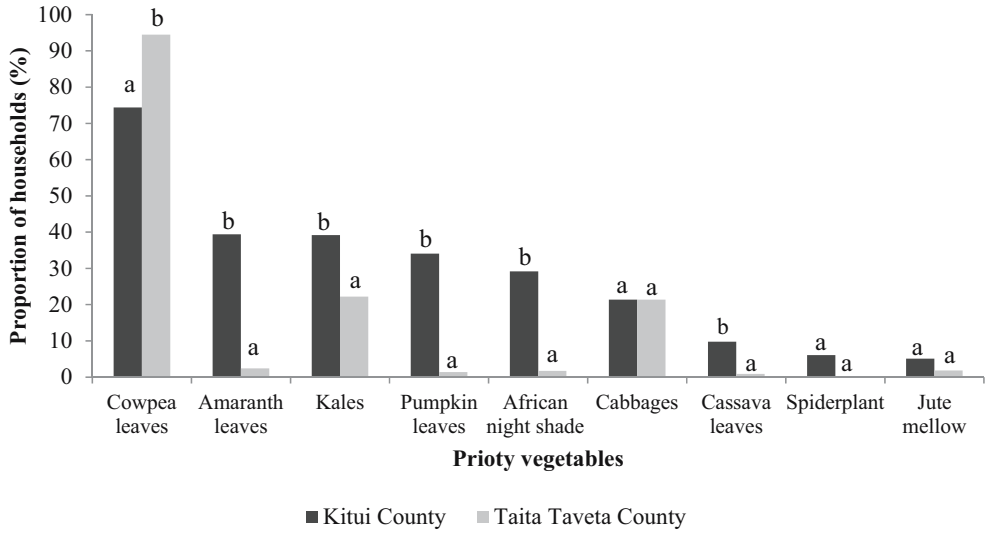

Figure 2: Priority vegetables in the study areas. Different letters for an attribute indicate significant difference at $p < 0.05$.

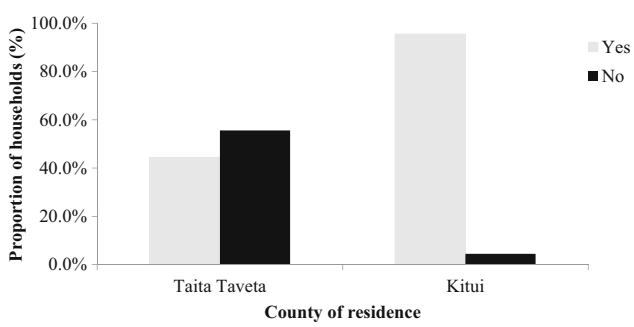

Figure 3: Prioritization of cowpea leaves as a farm produce based farm yields in the different counties. $p < 0.001$, df = 1 and $\chi^2 = 125.05$.

Table 2: Extent to which the challenge constrained the utilization and production of cowpea leaves by the households (%)

Constraint	Extent to which the challenge constrain production		
	Low	Moderate	Severe
Drought	7.6	12.4	79.9
Diseases	9.4	23.6	67.0
Field pest	11.5	30.2	58.4
Extension services	15	36.2	48.8
Price fluctuations	14.5	41.6	43.9
Lack of market	23.4	33.8	42.9
Weeds	15	42.4	42.6
Low prices	17.7	40.3	42.1
Access to seeds	16.5	60.7	22.8
Massive spoilage	26.5	51.1	22.4
Seed scarcity	23.4	54.4	22.2
Lack of land	23.4	54.4	22.2
Poor yields	31.9	47.9	20.2
Poor varieties	30	52.6	17.4
Poor soils	56.3	32.7	10.9

3 Constraints of utilization of cowpea leaves

The fitted linear model found that the household size and occupation of the household head were significant socio-economic and demographic factors that influenced the frequency of intake of cowpea leaves in the households (Table 4). With increasing household size, the frequency of weekly consumption of cowpea leaves increased with a correlation coefficient of 0.35 ($p < 0.001$). Additionally, households where the food to be bought was determined by the female had a weekly frequency of intake of cowpea leaves of 3.7 ± 1.9 which was significantly ($p < 0.001$) higher than that recorded in households where this decision was with the males, 3.0 ± 1.4. In seasons of scarcity, 75.1% of the households would either source the cowpea leaves from elsewhere or not eat them completely. A higher proportion of the households from Taita Taveta County (42.9%) as compared to those from Kitui County (4.5%) used the preserved forms of cowpea leaves during scarcity ($p < 0.05$).

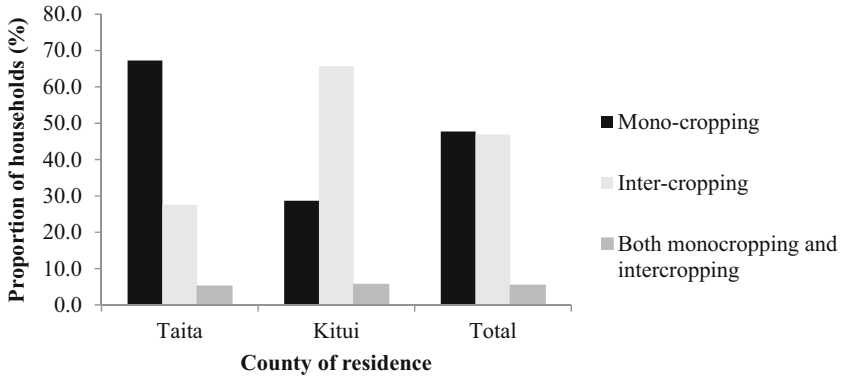

Figure 4: Association between county of residence and system of farming for cowpea leaves. $\chi^2 = 54.8$, $p < 0.001$ and df = 2.

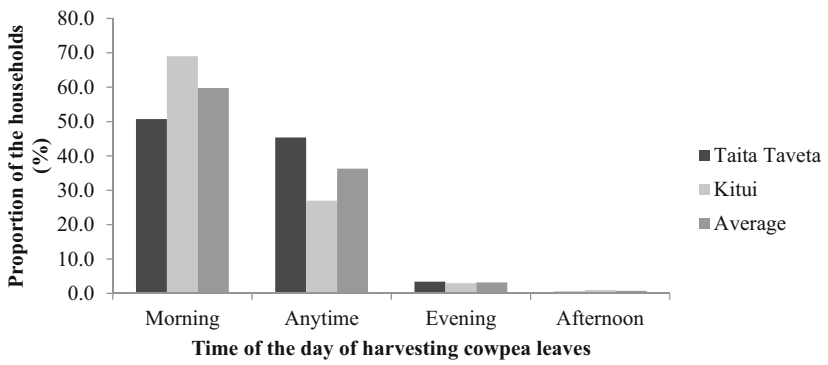

Figure 5: Association between time of harvesting cowpea leaves and county of residence. $\chi^2 = 15.5$, df = 3 and $p = 0.001$.

Table 3: Beta values for predictor factors of production quantity of cowpea leaves

Constraints on production	Beta values of intensity of constraints on production (odds ratios)	
	Low	Moderate
Field pest	0.4 (1.4)	−0.6 (0.5)
Seed scarcity	−0.4 (0.7)	−0.4 (0.7)
Lack of land	0.6 (1.9)	−0.2 (0.9)
Lack of market	0.4 (1.4)	0.6 (1.8)
Poor yields	−0.6 (0.5)	−0.7 (0.5)
Poor varieties	−0.5 (0.6)	−0.9 (0.4)
Poor soils	−0.2 (0.8)	−1.0 (0.4)*
Price fluctuations	0.6 (1.8)	0.4 (1.5)
Low prices	0.0 (1.0)	0.8 (2.2)
Drought	−1.1 (0.3)	−0.1 (0.9)*
Diseases	0.6 (1.7)	0.9 (2.5)
Lack of access to seeds	1.1 (3.0)	0.7 (2.0)*
Weeds	−0.2 (0.9)	2.5 (12.7)
Massive spoilage	0.9 (2.3)**	−0.4 (0.7)
Lack of extension services	0.6 (1.8)	0.6 (1.9)

The regression equation has an R^2 of 0.21 and a constant of 2.5 at $p < 0.05$. The reference category for both low and moderate groups is severe. *significant at $p < 0.05$, **significant at $p < 0.001$.

4 Discussion

4.1 Trends in production and utilization of cowpea leaves

The survey showed that households that produced and consumed cowpea leaves were mainly male headed with the average age of the household heads being 50 years. This implies that the crop is mostly farmed among the elderly population rather than the youthful age. Ddungu (2013) in his study in Uganda also reported a similar trend where the population farming cowpea leaves was dominated by the elderly. However, findings of a study done in Ghana and Tanzania were different as the farming population of cowpea leaves was dominated by the youthful age group (Mamiro et al. 2011; Akpalu et al. 2014). Kenya currently grapples with low involvement of the youth in agriculture and more so in subsistence agriculture like that of the production of cowpea leaves. The subsistence nature of this value-chain results in low revenue generation which has been adduced to low levels of adoption of appropriate inputs (Afande et al. 2015). Additionally, the land tenure system has been

Table 4: General linear model of the frequency of intake of cowpea leaves in a household based on their socio-demographic and economic factors

Socio-demographic and economic factors of the households	Degrees of freedom	Mean square	*p*-value
Intercept	1	70.636	0.000
Gender of the household head	1	1.56	0.213
Level of education of the household head	6	2.727	0.014
Main occupation of the household head	5	1.514	0.185
Who decides food to be bought in the household	2	2.549	0.020
Age of the household head	60	0.84	0.791
Number of household members	16	5.317	0.000
Monthly income	4	1.666	0.158

another factor that has contributed to the low involvement of youths in production agriculture in Kenya.

The production of cowpea leaves in the study areas was done in both monocropping and intercropping production systems. This finding is similar to that of a study carried out in Taita Taveta and Makueni Counties where farmers in various agro-ecological zones grew cowpeas in both intercropping and monocropping systems (Njonjo et al. 2019). The crop is a legume with nitrogen-fixing property and has always been recommended for intercropping, especially with cereals (Mucheru-Muna et al. 2010; Iqbal et al. 2019). Experimental studies by Egesa et al. (2016) reported more than 50% increase in sorghum yield in an intercropping production system as compared to a solely sorghum monocropping system. Additionally, Sebetha et al. (2010) reported an increase of 26.7% in the leaf protein of the intercropped cowpea leaves as compared to the monocropped. The attribute of the crop of early maturity has made it to be favoured in the ASAL areas (Njonjo 2018). Of the households that produced cowpea leaves, the harvesting began at 2 weeks and was done at an interval of a similar period. Based on the findings by Saidi et al. (2010), such a practise has a mixed impact on the leaf yield as delayed initiation of leaf harvesting to 3 weeks rather than of 2 weeks that was practiced in the current study and harvesting at an interval of 14 days (similar to that of the study) rather than 7 days improved the leaf yields.

The results indicated that cowpea leaves were a priority crop in the ASAL areas of the country. The prioritization of the crop in both the eastern and coastal ASALs of the country is as a result of its drought-tolerance property. According to the Horticultural Crops Directorate (2016), the leading cowpea leaves producing counties are in the ASALs of eastern and coastal regions of the country. The households in the ASAL areas relied on the farm as their major source of cowpea leaves. This has the implication that less marketing of the vegetable is done in the area and the crop is largely grown for subsistence. A study carried out in South Africa also reported that cowpea leaves were one of the least commercialized crops thus less trading on them is done (Lekunze 2014). With such limited commercialization, this exposes the farmers to huge postharvest losses during glut and massive scarcity of the vegetable during drought.

The study also found that cowpea leaves were consumed as boiled, blanched and sundried forms in the ASAL areas. These are majorly the traditional methods of preparation that have remained unchanged over the years. The consumption of cowpea leaves was found to be at least 3 days in a week with the eastern ASAL region of the country consuming about twice as frequent as the coastal ASAL areas. Such a level of intake of cowpea leaves has a nutritional advantage as Enyiukwu et al. (2018a) recommended the consumption of the leaves over the seeds for they are rich in minerals, vitamins and antioxidants that have disease prevention and nutrition-promoting characteristics. Moreover, the vegetables have also been found to be low in antinutrients, and thus the nutrients have a high bioavailability (Chikwendu et al. 2014). All households consumed their cowpea leaves from their own production during glut but had no cowpea leaves to consume or had to source from elsewhere during drought and seasons of scarcity. This shows insufficiency of the postharvest storing technologies of the leaves in this area in ensuring uninterrupted availability of the vegetable.

4.2 Constraints of production and utilization of cowpea leaves

Drought, diseases and field pests were found to be the most prevalent challenges experienced by farmers in the

ASAL areas of the country. Another study in Uganda that focused on cowpea production rated similar challenges of pest and diseases together with unreliable rainfall as among the most prevalent challenges constraining production (Ayaa et al. 2018). The challenges of pest and diseases and drought result in pre-harvest losses leading to low production quantities. The rural population also largely relied on landrace varieties for their production. This has the effect of limited yields being realized. Using the generated linear models, increasing severity of massive spoilage and constrained access to seeds as challenges aggravated limited production quantities of the leaves among the households. This limited access to seeds is evidenced by the high proportion of the households that rely on the landraces rather the improved varieties for cultivation. Massive spoilage limits the quantities available for use among the households, lest such households initiate postharvest management measures to preserve the leaves. Increasing severity of drought and poor soils did not constrain the production quantities of the households. The area of study is arid and the communities tend to have coping strategies to the adverse environmental conditions (Opiyo et al. 2015).

Smaller household sizes and households where males decided the food to be eaten recorded lower frequencies of intake of cowpea leaves. Lekunze (2014) in his market analysis study in South Africa reported that with increasing standards of living, households would abandon the cowpea leaves for other foods. Smaller households have usually been associated with higher living standards and this explains the positive correlation between household size and frequency of intake of cowpea leaves. Nevertheless, the consumption of cowpea leaves as reported in various studies has not been satisfactory despite them being nutritious. Gido et al. (2017) reported that the acceptance of cowpea leaves in the urban areas is still lower than in the rural areas as they preferred other forms of vegetables. Additionally, Mamiro (2011) reported a range of 10–500 g daily per capita consumption of cowpea leaves in season among the households with more extremities than the grains, 40–200 g. This is due to the prioritization of the harvesting of the seeds over the leaves as it has been established in other studies that harvesting of the leaves reduce the grain yield (Saidi et al. 2010). The harvesting of the leaves is usually abandoned to allow for development of the grains. Off-season utilization declined greatly as up to 75.1% of the households lacked their own production of cowpea leaves to consume. This is as a result of lack of appropriate postharvest technologies and inadequate production quantities that could sustain the households through the off-season period.

5 Conclusion

Cowpea leaves were a major source of food and a priority crop in the ASAL areas of Kenya. In times of glut, the households majorly relied on their own production for sourcing the vegetable; however, scarcity of the vegetable would have most households not consuming the crop. The major forms of utilization of the cowpea leaves in the ASAL areas were traditional with limited value-addition practices being done. The eastern ASAL regions have lesser diversity of forms in which they consume cowpea leaves as compared to the ASAL areas in the coastal region.

Pest, diseases and drought were major constraints that greatly constrained the utilization and production of cowpea leaves in these ASAL areas. Limited production quantities of the vegetable among the households were aggravated by the lack of access to good quality seeds and massive spoilage. In order to increase the availability and intake of the vegetables, it is necessary to address these two constraining factors among these cowpea producing households in ASAL areas.

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